

language. But it seems obvious that this diversity and complexity must have been evolved in the natural course, whether starting from one or many original centres.

At p. 163 a view is taken of the Aryan suffixes which many will be inclined to regard as a retrogressive step rather than an advance in linguistic studies. "We must rid ourselves of the notion that suffixes were ever independent words like our 'if' or 'in'; so far back as our knowledge of Aryan speech extends they possessed no existence apart from the words to which they belonged, and which, again, only existed as words in so far as they possessed these suffixes. Suffixes became flexions through the help of analogy." The point would involve too much technical matter to be here adequately discussed, but it may be remarked that our knowledge of Aryan speech is as of yesterday compared with the many ages it must have taken to reach the highly-inflected state presented by the oldest known members of the family. If in a brief thousand years or thereabouts the Latin ablative *mente* had time to become a Romance adverbial suffix, the verb *habeo* a verbal ending, and the adverb *inde* a pronoun with a genitival force, surely there was ample time in the ten, twenty, or fifty thousand years of the early lifetime of the organic Aryan speech for hundreds of independent words to pass from one part of speech to another, from the noun or verb to the particle, and thence to the relational suffix. And if "suffixes became flexions through the help of analogy," being hitherto "meaningless terminations" (*ib.*), it may be asked through the help of what analogy? At all events, the internal vowel change here taken as their pattern does not meet the case, for, if properly considered, all such internal vowel change must itself be regarded as primarily due to the influence of reduplication and flexion acting on the body of the word, and gradually becoming absorbed, often leaving no trace of its former presence beyond the very vowel change in question. Such seems undoubtedly to be the history of the strong Teutonic conjugation and of such Teutonic plurals as seem now to be effected by mere internal modification, just as we know that it is the history of such past tenses in Latin as *ēgi*, *fēci*. Two things it seems impossible to admit—the development or invention of "meaningless terminations," that is, meaningless *ab initio*, and internal vowel change with flexional force, produced, as it were, by spontaneous effort independently of outward influence, the influence either of reduplication or of pre- or postfixes reacting on the theme.

The chapter on Comparative Mythology, as expounded in the light of comparative philology, is thoroughly satisfactory, and will be read with pleasure even by those unfamiliar with the technicalities of the subject. In the last chapter, also, on the Origin of Language and collateral subjects, much excellent advice is given touching spelling reform, the pronunciation of the classical tongues, the application of sound linguistic principles to the teaching of languages, and many other points of a more practical nature.

There is an excellent analytical index supplied by Mr. W. G. Hird, but it does not dispense with the necessity of a full alphabetical index, which is urgently needed in a work overflowing with matter of the most varied description, and which it may be hoped will be supplied in future editions. Some oversights and casual slips in minor

points should then also be rectified, and with that view a few of the more important may here be noted. The *ve* in the Italian compound *portandovelo* (ii. 210) is derived from the Latin adverb *ibi*, used pronominally instead of from the pronoun *vobis*. The particle *vi*, *ve* often, of course, represents *ibi*, as in the sentence *io v'era* (lit. *ego ibi eram*); but it equally represents the pronoun, as in the sentence *io vi dico* (lit. *ego vobis dico*), and obviously in the compound in question. The Nogais (properly Nogais) are described (ii. 199) as "Russian Cossacks" instead of Tatars. The Nogais are of Türki stock, whereas all the Cossacks are of Slav stock, either Great Russians (Dön Valley, Cis-Caucasia, &c.), or Little Russians (Ukrania). The Cossacks are often spoken of as Tatars by careless writers, confounding them with the *Cassaks*, who, being Kirghizes, are true Tatars. It seems scarcely accurate to say that in the Greek and Latin sentences *τίπτε* and *amat* "the subject is not expressed" (ii. 329), seeing that *εἰ* (for *ἐτι*) and the *t* of *amat* are pronominal, though so old that they do not distinguish the gender of the subject referred to, and may possibly have originally been *objective* forms. The statement (i. 417) that "in Hindustani the genitive takes the marks of gender according to the words to which it refers," is apt to mislead the unwary, who might conclude from this that the Hindustani noun had cases, whereas there is nothing but a general oblique form followed by postpositions. One of these postpositions (*kā* = of) follows the gender of the noun of reference (*larkē-kā*, *larkē-kī* according to circumstances), but the noun remains unchanged. There is another reference (p. 423) to a point of Hindustani grammar, which as worded is unintelligible. The place of the definite article is not supplied "by a dative with the suffix *-ko*," for there are no datives, but by the postposition *ko*, which, though usually giving a dative force, often idiomatically emphasises the objective noun and thus does duty as a sort of definite article. The reference to Voltaire (i. 60) should be emended by shifting the places of the words "consonants" and "vowels." No one who has ever heard a native of Northern India speak any of the current neo-Sanskritic tongues will hesitate to transcribe the sonant explosives with the rough breathing (*gha*, *dha*, *bha*) by the side of *kha*, *tha*, *pha*, though the point is treated as doubtful (i. 281). The *h* in such words as *ghora*, *bhāṭ*, *dhobi* is heard quite as distinctly as it is in the English word *mad-house*. Lastly, such terms as "Turanian" (i. 325), "Alfurian," and even Malayo-Polynesian might well be dispensed with in future editions of a work, which as it stands reflects lasting credit on English scholarship, and which all will accordingly be anxious to see rendered even in small details as perfect as possible.

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#### STATICS

*Treatise on Statics.* By George Minchin, M.A. Second Edition. (Clarendon Press Series.)

SINCE the publication of Thomson and Tait's "Natural Philosophy," thirteen years ago, an important change in the treatment of the theory of dynamics has been making rapid progress. Previous to that time it was the almost universal practice to follow the French writers and to find a basis for the theory of the equilibrium of forces

independent of any consideration of motion. Force was often defined to be that which caused or tended to cause motion; but the theory of the combination and resolution of forces was founded on certain assumed axioms about the properties of forces without further reference to the effect by which force was described. The proof of the parallelogram of forces was to most beginners such a formidable *pons asinorum* that the broad conception that velocities, accelerations, and forces acting at given points were all fully represented by vectors, and that each could be added just in the same way as the vectors which represented them, was not soon grasped by the mind. Consideration of the fundamental principles of dynamics and of the philosophic position of the first law of motion, which at the same time defines the measure of time and states a law of nature, was avoided, and the theory of the motion of matter became a development of the equations of statics.

Thomson and Tait returned to the order of Newton and abolished artifices from the foundations of the science of dynamics. The influence of Thomson and Tait's "Natural Philosophy" on the volume before us is apparent in the first chapter. The proofs of the parallelogram of forces by Duchayla and Duhammel are conspicuously absent, and the fundamental proposition of statics is deduced quite naturally from consideration of the parallelogram of velocities. When it is once admitted that statics should rest on Newton's laws of motion, the appropriateness of a separate treatise on the subject, to include electrostatics and elasticity, becomes questionable. Why should dynamics be divided and a separate treatise be written on that portion from which it is possible to exclude the idea of mass? A book on the analysis of systems of forces or "wrenches" deals with a natural group of propositions, so does a book on attractions, on electrostatics, or the relations of stresses and strains. But we cannot see that it is natural to group those subjects together with the view, as it would appear, that the student should make himself acquainted with them before mastering the dynamics of a particle. Indeed, however we may admire each chapter of Prof. Minchin's work, we cannot help regretting that he has limited his subject-matter by the title of the volume.

At the end of each chapter is an abundant selection of examples—a very necessary part of an educational work on any department of mathematics. It would have been well that amongst these should have been found a larger proportion of examples demanding a numerical answer; the best students show a liability to failure in rapidly dealing with dynamical questions when concrete numbers take the place of the more familiar symbols.

It is not often that a graduate of Dublin University omits to set forth in its proper place the work of a Dublin professor. Any one would have looked with considerable confidence in Chapter X. of Minchin's "Statics" for some account of Ball's theory of screws as a sequel to Poinso's central axis, but he would be disappointed. As that theory is very instructive as well as exceedingly elegant, the omission is a loss to the student.

Chapter IX. is devoted to friction, and ends with four articles on the friction of a pivot, based on the assumption that the pressure between pivot and footstep is uniform over the surfaces in contact; and in Art. 134 the equation

of the tractory is found by a further condition that the vertical wear shall be constant. As a fact, when a pivot has been at work for some time the vertical wear becomes of necessity constant, and thence may be deduced the normal pressure at any point which will not be constant unless the form of the pivot be the tractory. As an illustration we propose the following to our readers: A conical footstep is to bear a maximum load with a minimum frictional moment; show that it should have a hole in the middle one-third the diameter of the footstep. A similar consideration may be applied to ascertain the distribution of pressure between a horizontal shaft and an ordinary bearing.

The book ends with a chapter on stresses and strains and their relation to each other. The examples appended to this chapter will be found most useful to the student; so far as we know he will not find elsewhere such facilities for testing his skill in this department of dynamics. Although we do not think it desirable that the departments of the science of dynamics should be classified for teaching purposes into statics and kinetics so completely as the present volume implies, we can heartily recommend each several chapter for the subject on which it treats, and we hope that Prof. Minchin will produce a work dealing with kinetics, and that when a fresh edition of both is demanded he will weld them into a single treatise on dynamics.

#### AUSTRALIAN ORCHIDS

*Australian Orchids.* By R. O. Fitzgerald, F.L.S. Part V. (Sydney, N.S.W.)

THE part of this beautiful and instructive work which has just reached us contains ten plates, illustrations of sixteen species belonging to the genera *Prasophyllum*, *Thelymitra*, *Sarcocilus*, *Dendrobium*, *Pterostylis*, *Cleisostoma*, and *Bolbophyllum*, all full of analyses, displaying in a very satisfactory manner the forms, disposition, and, in many instances, the development of the reproductive organs; whilst the letterpress is as full as is that of previous parts, of curious and instructive observations on the habits of the species and their modes of fertilisation. Whether, in point of scientific importance, or fulness of illustration, there are few works upon the Orchideæ to compare with this, certainly none at all comparable to it has ever been attempted in a colony. Its only rivals are the magnificent orchideous plates in Blume's "*Rumphia*," and in his still more beautiful "*Orchideæ of the Indian Archipelago*." On the other hand, in respect of descriptive matter the works of these two authors widely differ. Blume had to deal with a host of previously unanalysed and unnamed generic and specific forms, which he classified and described in a truly masterly manner, and his works are hence almost purely systematic. The materials for the "*Australian Orchids*" had been for the most part classified by Brown in the "*Prodromus Flora Novæ Hollandiæ*," with a skill equal to that subsequently displayed by Blume in respect of the Indian ones, and Mr. Fitzgerald has therefore rightly devoted his descriptive matter chiefly to the "life-history" of the species. As a specimen of this we may quote his observations on *Prasophyllum fimbriatum*:—

"This little flower presents another of the anomalies